

**BEFORE THE  
NATURAL RESOURCES COMMISSION  
OF THE  
STATE OF INDIANA**

**IN THE MATTER OF:**

<b>AMENDMENTS TO 312 IAC 2 AND</b>	)	<b>Administrative Cause</b>
<b>312 IAC 8 GOVERNING ACTIVITIES</b>	)	<b>Number 11-052A</b>
<b>ON DNR PROPERTY</b>	)	<b>(LSA Document #11-442(F))</b>

**REPORT ON RULE PROCESSING, PUBLIC HEARING AND  
WRITTEN COMMENTS, DNR RESPONSES TO COMMENTS, AND HEARING  
OFFICER ANALYSES AND RECOMMENDATION REGARDING FINAL ADOPTION**

**1. RULE PROCESSING**

For consideration are proposed amendments to 312 IAC 2 and 312 IAC 8 governing activities on Department of Natural Resources property. With the transfer of J. Edward Roush Lake (previously known as "Huntington Reservoir" or "Huntington Lake") from management by the Division of State Parks and Reservoirs to management by the Division of Fish and Wildlife, 312 IAC 2-4-12 would remove Huntington Lake from the listing of lakes that are subject to standards governing fishing tournaments. Amendments to 312 IAC 8-2-3 clarify or establish requirements on a DNR property for hunting blinds; prohibiting the possession of lead shot while hunting mourning doves; and the taking of reptiles and amphibians. Amendments to 312 IAC 8-2-8 would remove the references to specific types of an "airborne human transportation device" or "motor-driven transportation device", including hang gliders, hot air balloons, aircraft, and tow kites. With the use of new inclusive terms at 312 IAC 8-2-8, proposed also is the deletion of 312 IAC 8-2-9(d), which provides standards applicable exclusively to the use of tow kites.

The Commission gave preliminary adoption to the rule amendments on May 17, 2011. As reported in the pertinent portions of the May 17 minutes:

Mark Reiter, Director of the Division of Fish and Wildlife, presented this item. With the transfer of J. Edward Roush Lake (formerly known as "Huntington Lake") from the management by Division of State Parks and Reservoirs to the Division of Fish and Wildlife, Roush Lake is proposed to be deleted from 312 IAC 2-4-12(b), which governs the conduct of fishing tournaments on reservoirs. Fishing tournaments scheduled at Roush Lake would be permitted by the Division of Fish and Wildlife as a special use.

Reiter said proposed amendment at 312 IAC 8-2-3(h) would offer clarification by adding references to the rules governing deer and waterfowl hunting, which contain specifications for hunting blinds on DNR property.

Amendments at 312 IAC 8-2-3(j) would correct a reference to scientific purposes licenses and would correct an administrative code reference to taking reptiles and amphibians on DNR property. "It's just making it clear that game frogs and turtles can be taken with hunting or fishing license not only with a scientific purposes license."

312 IAC 8-2-3(k) would prohibit the possession of lead shot while hunting mourning doves on a DNR property. Reiter said that in 2008, the Division of Fish and Wildlife posted signs on its properties regarding the prohibition and started an education-information campaign for dove hunters to inform that the prohibition would become effective in 2009. The prohibition was extended to reservoir properties in 2010. "We heard very little from hunters in opposition of that. It's a common trend on public property across the nation, especially in dove hunting field. Manufacturers are making nontoxic shot in all gauges and loads."

Reiter said the amendment to 312 IAC 8-2-8 would remove the references to specific airborne human transportation devices, including hang gliders, hot air balloons, aircraft, and tow kites. The removal of specific references would not change the requirement that a license is needed to use an airborne human transportation device or motor-driven airborne device on a Department property, unless the activity takes place at a DNR site designated for the particular purpose. Reiter said the terms "airborne human transportation device" and "motor-driven airborne device" would be more inclusive and would cover any transportations devices that are available in the future. With the use of new inclusive terms at 312 IAC 8-2-8, proposed is the deletion of 312 IAC 8-2-9(d), which provides standards applicable exclusively to the use of tow kites.

The Chair noted the issue of the use of tow kites on DNR properties was brought before the Commission in the form of a petition for a rule change. He asked whether the petitioner was involved in the proposed rule amendments.

Steve Hunter said the Department has involved the petitioner in discussions regarding the rule proposal. He added that the petitioner's request was directed primarily to the use of a tow kite on a particular fish and wildlife access site. The petitioner's request was handled under the permitting process.

Mark Ahearn moved to give preliminary adoption of amendments to 312 IAC 2-4-12 governing fishing tournaments and 312 IAC 8 governing activities on DNR properties. R. T. Green seconded the motion. Upon a voice vote, the motion carried.

The "Notice of Intent" to adopt a proposed rule amendment was posted to the INDIANA REGISTER at 20110803-IR-312110442NIA on August 3, 2011. The notice identified Linnea Petercheff, Department of Natural Resources, Division of Fish and Wildlife, as the "small business regulatory coordinator" for purposes of Indiana Code § 4-22-2-28.1.

As specified by Executive Order, proposed fiscal analyses of the rule proposal were submitted, along with a copy of the proposed rule language and a copy of the posted Notice of Intent, to the Office of Management and Budget on August 4, 2011. In a letter dated September 28, 2011, Adam M. Horst, Director, Office of Management and Budget, recommended that the proposed rule amendments be approved.

The Division of Hearings submitted the rule proposal to the Legislative Services Agency, along with the "Statement Concerning Rules Affecting Small Business" (also known as the "Economic Impact Statement") on October 4, 2011. The Notice of Public Hearing was submitted to the

Legislative Services Agency on October 5, 2011. On October 19, 2011, the following were posted to the INDIANA REGISTER: the text of the proposed rule at 20111019-IR-312110442PRA; the notice of public hearing along with the justification statement (IC 4-22-2-24(d)(3)) at 20111019-IR-312110442PHA; and the Economic Impact Statement at 20111019-IR-312110442EIA. Following receipt of an “Authorization to Proceed” from the Legislative Services Agency on October 5, 2011, the Division of Hearings caused a Notice of Public Hearing to be published by the Indianapolis Newspapers in the Indianapolis *Daily Star*, a newspaper of general circulation in Marion County Indiana, on October 12, 2011. In addition, the notice of the public hearing and a summary of the proposed rule changes were published on the Commission’s web-based electronic calendar.

## **2. PUBLIC HEARING AND WRITTEN COMMENTS**

### **a) Public Hearing**

On November 16, 2011, the public hearing was convened as scheduled by Stephen Lucas of the Commission’s Division of Hearings. In attendance was Linnea Petercheff with the Department’s Division of Fish and Wildlife.

### **b) Written Comments**

Written comments were received through the Commission’s general rule proposal email address<sup>1</sup> and through the Commission’s online comment form accessible at <http://www.in.gov/nrc/2377.htm>. On November 21, 2011, the comment period closed. Comments were submitted as follows:

#### **Tim Current, Warren, IN (July 27, 2010)**

I can understand some of the reasoning behind this proposal, but I do not believe there is any scientific or historical justification for it. I have yet to see any reports or statistics that would indicate Indiana has a safety issue with concealed ground blinds. This proposal amounts to nothing more than a “good idea on paper”. It is not needed and will only mean additional cost to hunters, many of which are already struggling financially.

#### **Robert Beeler, Howard County, IN (August 1, 2010)**

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<sup>1</sup> Prior to the creation of the online comment form at <http://www.in.gov/nrc/2377.htm>, comments were submitted through a general email address dedicated to comments regarding proposed rules. Information Bulletin #55 (Second Amendment) provides guidelines regarding submittal and receipt of those comments. See <http://www.in.gov/legislative/iac/20100804-IR-312100484NRA.xml.pdf>.

I believe there should be orange either on top or middle of hunting blind.

**Ryan Altman, Brookston, IN (August 1, 2010)**

The rule about 144 inches of blaze orange on a blind brings up a general visibility question for me. A hunter is legal if all he has on is solid blaze gloves. However, if a hunter has a hat, shirt, and vest that might not be solid but has three or four times more orange on it is considered not legal. I have been in this situation before. Finding solid orange equipment is getting harder to do. If you are planning on requiring a certain amount of orange based on inches for a blind, how about changing the clothing law to inches also.

**Commentor Name** Danny S. Smith

**Commentor County** 90

**Commentor State** IN

**Commentor City** Bluffton

**Commentor Organization**

**Commentor Email** [Email Commentor](#)

**Comment** Please adopt the rule changes as written. I support them.

**Time stamp** 06/09/2011 08:42:46 PM

**Commentor Name** Alan K Shourds

**Commentor County** 74

**Commentor State** IN

**Commentor City** Chrisney

**Commentor Organization**

**Commentor Email** [Email Commentor](#)

**Comment** There are those of us who use muzzleloading shotguns for the majority of our hunting. With the uncertainty of the only suitable alternate to lead, bismuth, for use in original guns, and considering the small amount of shots taken, how about an exemption for muzzle loaders?

**Time stamp** 07/01/2011 07:06:20 PM

**Commentor Name** Robert Eber

**Commentor County** Out of State

**Commentor State** IN

**Commentor City** Rochester

**Commentor Organization**

**Commentor Email** [Email Commentor](#)

**Comment** I am for decreasing the number of the deer population in our area.

**Time stamp** 07/10/2011 02:54:03 PM

**Commentor Name** Brian Owen

**Commentor County** Out of State

**Commentor State** IN

**Commentor City** Martinsville

**Commentor Organization**

**Commentor Email** [Email Commentor](#)

**Comment** This is much better than the first proposal. I like it.

Brian Owen

**Time stamp** 07/16/2011 08:32:16 PM

**Commentor Name** Randall J. Burns

**Commentor County** 25

**Commentor State** IN

**Commentor City** Akron

**Commentor Organization**

**Commentor Email** [Email Commentor](#)

**Comment** 312 IAC 8-2-3 Firearms, hunting, and trapping Version b

Sec. 3. (a) A person must not possess a firearm or bow and arrows on a DNR property unless----. This seems to fly in the face of recent Indiana right to carry legislation, effective July 1. One of the provisions was to outlaw localized limitations on carrying a weapon. You give the appearance of saying: "Not Here!".

On another section: Use of non-lead on most of the state dove areas I have seen is a needless expense. Lead is non soluble, does not move around, and when used over dry ground, should be allowed.

**Time stamp** 07/26/2011 11:29:41 AM

**Commentor Name** John Kevin Haendiges

**Commentor County** 31

**Commentor State** IN

**Commentor City** Ramsey

**Commentor Organization**

**Commentor Email** [Email Commentor](#)

**Comment** I approve of these rules as written with the exception of the ban on lead shot for hunting Mourning Doves. Non-lead shot such as steel reduces the force of the shot column unreasonably risking crippled birds, and bismuth is too expensive for dove shooting.

**Time stamp** 08/11/2011 05:45:07 PM

**Commentor Name** Douglas England

**Commentor County** 22

**Commentor State** IN

**Commentor City** New Albany

**Commentor Organization** city of new albany

**Commentor Email** [Email Commentor](#)

**Comment** I feel this restriction would have an economic impact on our community as well as those along the Ohio River. We have many bass fishing events on the Ohio River and the attendance has been very excellent. With this Bill being passed it would have a drastic impact on all the communities on the Ohio River bordering Indiana. I am asking you to reconsider the legislation pertaining to the Ohio Riner and it's tributeries. Appreciate your time and help with this matter.

**Time stamp** 10/14/2011 08:49:15 AM

**Commentor Name** Michael G. Radke

**Commentor County** 92

**Commentor State** IN

**Commentor City** Columbia City

**Commentor Organization** self

**Commentor Email** [Email Commentor](#)

**Comment** Hello-- comment 1. I am handicapped and have a permit for the crossbow in archery season. Will the new rule mean I cannot get a regular archery license to hunt with my crossbow.

comment 2. why not have a license bundle for retired senions at a reduced price like \$13.00 per license. This would give the seniors who are on a fixed income a break and still allow the DNR to collect from the Federal taxes for each license. Simular to fishing license.

comment 3. Allow deer herd reduction in all counties.

comment 4. Have a Buck Only license for those who won't shoot an anterless deer at an increased license fee-like \$48.00. have box on license marked buck only and this has to be declared at time of purchase.

comment 5. Does the urban zone license mean the hunter can take a buck in the urban zone and a buck in the rest of the state hunting areas(state & Private).

comment 6. PLEASE allow more notice of meetings so citizens can attend these meetings and be represented fairly.

Thank you

**Time stamp** 01/11/2011 08:28:34 AM

**Commentor Name** Josh Sargent

**Commentor County** 89

**Commentor State** IN

**Commentor City** Richmond

**Commentor Organization**

**Commentor Email** [Email Commentor](#)

**Comment** I'm in 100% favor and agreement with this proposed rule change if it allows hunters to leave a portable hunting blind on DNR property. I'm still a bit unclear on what the proposed rule change actually says.  
**Time stamp** 01/13/2011 05:03:03 AM

**Commentor Name** DIANA aKERS  
**Commentor County** Out of State  
**Commentor State** FL  
**Commentor City** boca raton  
**Commentor Organization**  
**Commentor Email** [Email Commentor](#)  
**Comment** Please don't make it easy to kill. Better yet, don't authorize killing.  
**Time stamp** 05/03/2011 05:33:34 AM

**Commentor Name** maurene schlosz  
**Commentor County** Out of State  
**Commentor State** DE  
**Commentor City** tennasee  
**Commentor Organization**  
**Commentor Email** [Email Commentor](#)  
**Comment** Please if people want to confine fox and coyote then do so in a humane way. These animals are wild, give them plenty of space in which to roam and defend themselves and not in a confined way so that their lives are lived in fear, pain and torture.  
**Time stamp** 05/03/2011 06:26:10 AM

**Commentor Name** Theodore Zagar  
**Commentor County** 45  
**Commentor State** IN  
**Commentor City** East Chicago  
**Commentor Organization**  
**Commentor Email** [Email Commentor](#)  
**Comment** I oppose using live animals of any species to train animals to hunt.  
**Time stamp** 05/16/2011 10:29:59 PM

**Commentor Name** Nick Yarde  
**Commentor County** 35  
**Commentor State** IN  
**Commentor City** Huntington  
**Commentor Organization**  
**Commentor Email** [Email Commentor](#)  
**Comment** I'm interested in why a series of public meetings and ample opportunity to comment on nearly pointless rules? When the DNR decided to eliminate Rousch lake as a recreation area did anyone seek comment from our community, offer a public hearing or allow opportunity to comment? Let's back up from these rule changes and address this bigger issue.  
**Time stamp** 02/24/2011 03:31:52 PM

**Commentor Name** Lisa Dinkins  
**Commentor County** Out of State  
**Commentor State** NC  
**Commentor City** Wilmington  
**Commentor Organization**  
**Commentor Email** [Email Commentor](#)  
**Comment** I am appalled to learn that the State of Indiana is considering legalizing coyote and fox penning year-round, where coyotes and foxes are placed in fenced enclosures and packs of dogs chase them in competition. Evidence shows that many of these wild canines are mauled and killed by their domestic cousins. In essence, Indiana is considering sanctioning an activity where animals can be torn apart as "live bait" in canned-hunting-like operations. This is reprehensible and contravenes any notion of fair chase. Like the rest of the nation, Indiana has banned dogfighting and cockfighting. Coyote and fox penning is akin to both activities and for this reason alone should be banned. The inherent cruelty associated with fox and coyote penning cannot be remedied through regulation. Creating new

rules would require enforcement, and enforcing abhorrent activities of this type is not an appropriate use of state resources in the best of times, and certainly not during these hard economic times.

The Indiana Department of Natural Resources has acknowledged that there is ecological, ethical, disease, and health related issues, associated with penning; and Florida unanimously voted to prohibit this type of penning last year. Indiana should do the same.

I urge you to reject the proposal to legalize coyote and fox penning and instead adopt rules to ban this practice. I strongly oppose coyote and fox pens, and respectfully ask that you stop this horrific and cruel practice.

Expanded Points for Your Letter:

**Ethically Indefensible:** Capturing, transporting, marketing, and penning wild animals for dog training is inherently cruel and should be banned for this reason alone. Pitting domestic canines against their wild cousins is ethically indefensible. Legislators have had the wisdom to ban dog and cock-fighting – largely on ethical grounds – and “penning” parallels these abhorrent practices. Penned wild coyotes and foxes are often mutilated in a cruel and unconscionable way, as acknowledged by the Indiana Department of Natural Resources.

**Ecologically Reckless:** Transporting and marketing wild coyotes and foxes for penning purposes is ecologically reckless. The Indiana Department of Natural Resources explicitly stated these concerns acknowledging that trade and transportation of wildlife is one of the primary contributors to disease transmission and historically has led to the spread of rabies and other diseases dangerous to wildlife, domestic animals and people.

**Counter to Sound Scientific Wildlife Management:** Coyote and fox penning is not an effective method of coyote and fox control as acknowledged by numerous and prominent scientists and wildlife biologists. There is no scientific evidence to support the claim that penning operations somehow help reduce coyote/fox populations on a state-wide level or mitigate negative encounters with coyotes or foxes. The Indiana Department of Natural Resources has acknowledged that there are ecological, ethical, and disease and health related issues associated with penning. Moreover, the Midwest Association of Fish and Wildlife Agencies passed a resolution in 2008 urging the adoption of state-by-state regulations prohibiting the importation or interstate movement of foxes and coyotes for the purpose of stocking coursing pens or for release and pursuit by hounds outside of coursing pens.

**Time stamp** 05/03/2011 04:35:32 AM

### 3. DNR RESPONSES TO COMMENTS

In an email dated December 14, 2011, Linnea Petercheff of the Division of Fish and Wildlife provided the following response to citizen comments. Included with Petercheff’s comments was an article, “Effects of Lead Shot Ingestion on Captive Mourning Dove Survivability and Reproduction”, which is set forth in Exhibit “B”:

Research has shown that the ingestion of lead by doves can result in their death, or if they survive, it can negatively affect their reproductive potential. At least 15 other states, including Illinois, require non-toxic (lead-free) shot for dove hunting on public land. State Fish and Wildlife Areas have not allowed the use of lead shot on dove fields for two (2) years by posted signs at the properties. In 2008, the Division of Fish and Wildlife distributed educational materials to dove hunters at Fish and Wildlife Areas explaining the concerns about the use of lead shot and intent to allow only non-toxic shot in the future. Starting in 2009, Fish and Wildlife Areas began prohibiting the use of lead shot for hunting doves on their properties through posted signs as authorized in 312 IAC 8-2-1. State reservoirs also began an educational campaign and have been prohibiting the use of lead shot for dove hunting on their properties starting in 2010. All manufacturers of shotgun shells now have non-toxic shot available for use for hunting doves and most other species, and it is readily available. An approximate cost of lead shot is \$6 a box, while the cost of steel shot is approximately \$10 a box. Lead shot can still be used to hunt rabbits, squirrels, quail, pheasants, and wild turkeys on most (but not all) DNR properties.

Federal regulations already prohibit the use of lead shot for hunting waterfowl. Attached is an article about the effects of lead shot ingestion on mourning doves

#### **4. HEARING OFFICER ANALYSES AND RECOMMENDATION REGARDING FINAL ADOPTION**

The proposed amendments govern properties that are owned by the State of Indiana and managed by the Department of Natural Resources. They assist with the implementation of agency duties on these properties and are authorized by statute. For the most part, the amendments would implement what are mostly housekeeping measures. The removal of Roush Lake from the listing in 312 IAC 2-4-12 reflects the redesignation of a property that was formerly administered by the Division of State Parks and Reservoirs to one that is administered by the Division of Fish and Wildlife. In practice, there will be little if any change. The language for tree blinds and other hunting blinds in 312 IAC 8-2-3 reconciles the requirements in 312 IAC 8 with those already existing in 312 IAC 9 (commonly referred to as the “Fish and Wildlife Rules”). The proposed amendments pertaining to hunting blinds do not establish new hunter orange requirements. Protections for frogs and turtles on DNR properties are clarified as applying to additional species.

A licensure requirement is extended to the use of all airborne transportation devices and motor-driven airborne devices used on a DNR property. These changes to 312 IAC 8-2-8 and 312 IAC 8-2-9 would be consistent with the results of a Commission action several months ago denying a citizen petition and the policy choices expressed at the time.

The most notable substantive change may be to a prohibition on the use of lead shot to take mourning doves. Two citizen comments opposed these changes, and the question is ultimately a policy matter for Commission disposition. The hearing officer is, however, convinced by the DNR’s response to these comments. Although lead shot may not be soluble in the absence of water, a site on a DNR property that supports dove hunting will most likely be wet on occasion. The hearing officer sees no conflict with the Commission’s decision to allow generally the possession of firearms on DNR properties and a decision to limit hunting mourning doves with the use of non-lead shot.

Other citizen comments are seemingly directed to rule proposals other than those currently under consideration.



The hearing officer recommends the Natural Resources Commission give final adoption to the proposed amendments to 312 IAC 2-4 and 312 IAC 8, without modification, as posted for preliminary adoption and set forth in Exhibit "A".

Dated: December 16, 2011

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Stephen L. Lucas  
Hearing Officer

**Exhibit "A"****TITLE 312 NATURAL RESOURCES COMMISSION****FINAL Rule**  
LSA Document #11-442(F)**DIGEST**

Amends 312 IAC 2-4-12 by removing J. Edward Roush Lake (formerly known as "Huntington Reservoir") from the listing of lakes that are subject to standards governing fishing tournaments. Amends 312 IAC 8-2-3 by clarifying requirements for hunting blinds, prohibiting the use of lead shot while hunting mourning doves, and clarifying requirements for the taking of reptiles and amphibians on a DNR property. Amends 312 IAC 8-2-8 by clarifying requirements for the use of airborne transportation devices and motor-driven airborne devices used on a DNR property. Amends 312 IAC 8-2-9 by removing the reference to tow kite flying. Amends 312 IAC 8-2-9 by removing the reference to tow kite flying. Effective January 1, 2013.

**312 IAC 2-4-12; 312 IAC 8-2-3; 312 IAC 8-2-8; 312 IAC 8-2-9****SECTION 1: 312 IAC 2-4-12 IS AMENDED TO READ AS FOLLOWS:****312 IAC 2-4-12 Limitations on fishing tournaments at lakes administered by the division of state parks and reservoirs****Authority: IC 14-10-2-1; IC 14-10-2-4; IC 14-15-7-3****Affected: IC 5-14-3; IC 14**

Sec. 12. (a) This section governs fishing tournaments at lakes administered by the division of state parks and reservoirs.

(b) The number of boats that may participate in a fishing tournament must not, on any date, exceed the following:

	Monroe	Salamonie	Mississinewa	<del>Huntington</del>	Brookville	Hardy	Patoka	Lieber	Raccoon
March	100	75	75	<del>18</del>	100	30	178	50	100
April	175	75	75	<del>18</del>	100	30	178	50	60
May	175	75	75	30	100	20	178	28	50
June	175	30	30	30	75	20	125	28	50
July	175	30	30	30	75	20	125	28	50
August	175	30	30	30	75	20	125	28	50
September	175	75	75	30	100	20	178	28	60
October	175	75	75	<del>18</del>	100	30	178	50	100
November	100	75	75	<del>18</del>	100	30	178	50	100

(c) A boat used to administer a tournament is excluded in determining the number of participating boats.

(d) The director may authorize a license for a fishing tournament under this section where the participants are not provided advance notice of the location. The name of the lake may be omitted from the license application, but the department must be provided with the name of the lake at least ten (10)

days before the tournament. A license issued under this subsection does not authorize a fishing tournament that conflicts with another license issued under this section. Subject to IC 5-14-3, the department will not publish the location of a fishing tournament issued under this subsection.

(e) Notwithstanding subsection (b), a fishing tournament on Monroe Lake, from October 15 through the end of February, is restricted to a maximum of one hundred (100) participating boats.

(f) At least thirty (30) days before the scheduled event, a license holder must file a certificate of insurance or an insurance binder with the department. The certificate of insurance or insurance binder shall name the license holder and the department as insureds and shall demonstrate the license holder has obtained an irrevocable general liability insurance policy with a limitation for each of the following of not less than:

- (1) One hundred thousand dollars (\$100,000) for all damages to property for a single occurrence.
- (2) One hundred thousand dollars (\$100,000) for injury or death of one (1) person in a single occurrence.
- (3) Three hundred thousand dollars (\$300,000) for injury to or death of multiple persons in a single occurrence.

(g) Attached to the application for each property, the applicant must deliver a cash bond or other security approved by the department in the amount of one hundred fifty dollars (\$150). Bond may be forfeited for any of the following reasons:

- (1) Failure to:
  - (A) pay the user fee within the prescribed time frame;
  - (B) cancel the event within thirty (30) days from the date the application was submitted; or
  - (C) comply with section 9.5 of this rule.
- (2) Restoration of the mooring judge's or spectators' area.
- (3) Reimburse to the department for cost of supervision, maintenance, and labor.
- (4) To collect any other unpaid fees or costs that are due, including expenses incurred in the collection of the unpaid fees.

(h) Within fourteen (14) days after a tournament, the license holder must provide to the department a user fee equal to the greater of:

- (1) eighty percent (80%) of the number of boats listed on the license; or
- (2) the number of boats participating in the tournament.

If the user fee under this subsection is greater than the amount of the bond, the organization is also responsible for the difference.

(i) The amount of the fee shall be established by the director within a range of fees for this purpose approved by the commission. The director may waive the user fee if the:

- (1) tournament is held for charity where all of the profits are given to that charity; and
- (2) waiver request is:
  - (A) made in writing; and
  - (B) submitted with the application.

(j) The director may require insurance in addition to what is set forth in subsection (f) if the director determines a fishing tournament poses an unusual risk of liability to the department.

(k) A license holder shall:

- (1) indemnify;
- (2) defend;

(3) exculpate; and

(4) hold harmless;

the department and its officials, employees, and agents from liability due to loss, damage, injury, or other casualty to the person or property of anyone arising directly or indirectly from the activity.

(l) The department may deny a license application or may revoke a license issued under this section if any fee or cost provided under this section is delinquent. Upon the satisfaction of any delinquencies, an individual may apply for a new license. *(Natural Resources Commission; 312 IAC 2-4-12; filed Aug 3, 2001, 10:54 a.m.: 24 IR 3932, eff Jan 1, 2002; readopted filed Oct 2, 2002, 9:10 a.m.: 26 IR 546; filed May 27, 2003, 12:35 p.m.: 26 IR 3320, eff Oct 1, 2003; filed Jan 5, 2005, 11:00 a.m.: 28 IR 1460; filed Jun 29, 2007, 2:32 p.m.: 20070725-IR-312060333FRA; readopted filed Jul 21, 2008, 12:16 p.m.: 20080813-IR-312080052RFA; filed Nov 1, 2010, 11:30 a.m.: 20101201-IR-312090986FRA, eff Jan 1, 2011)*

SECTION 2. 312 IAC 8-2-3 IS AMENDED TO READ AS FOLLOWS:

**312 IAC 8-2-3 Firearms, hunting, and trapping**

**Authority:** IC 14-10-2-4; IC 14-11-2-1; IC 14-22-2-6

**Affected:** IC 14-22-11-1; IC 35-47-2

Sec. 3. (a) A person must not possess a firearm or bow and arrows on a DNR property unless one (1) of the following conditions apply:

(1) The firearm or bow and arrows are:

(A) unloaded and uncocked; and

(B) placed in a case or locked within a vehicle.

(2) The firearm or bow and arrows are possessed at, and of a type designated for usage on:

(A) a rifle;

(B) a pistol;

(C) a shotgun; or

(D) an archery;

range.

(3) The firearm or bow and arrows are being used in the lawful pursuit of either of the following:

(A) A wild animal on a DNR property authorized for that purpose.

(B) A groundhog as authorized under a license.

(4) The person possesses a handgun on a DNR property other than a reservoir owned by the U.S. Army Corps of Engineers or Falls of the Ohio State Park:

(A) with a valid unlimited license to carry a handgun:

(i) issued under IC 35-47-2-3; or

(ii) recognized under IC 35-47-2-21(b); or

(B) pursuant to an exemption to handgun licensure requirements as authorized under IC 35-47-2-2.

(b) Except as provided in subsection (a)(1) or (a)(4), a firearm or bow and arrows may not be possessed on DNR properties within any of the following:

(1) A nature preserve unless hunting is authorized under subsection (d).

(2) A property administered by the division of state museums and historic sites.

(3) A campground.

(4) A picnic area.

(5) A beach.

(6) A service area.

(7) A headquarters building.

(8) A hunter check station.

(9) A developed recreation site.

(c) A person must not discharge a firearm or bow and arrows on a DNR property except as follows:

- (1) As authorized for a law enforcement officer.
- (2) In the lawful defense of persons or property.
- (3) Under a department permit that authorizes the discharge.
- (4) As authorized at a shooting range.
- (5) In the lawful pursuit of wild animals. The exception provided in this subdivision does not apply within two hundred (200) feet of any of the following:
  - (A) A campsite.
  - (B) A boat dock.
  - (C) A launching ramp.
  - (D) A picnic area.
  - (E) A bridge.

(d) A person may hunt on the following DNR properties:

- (1) A state forest administered by the division of forestry, including a portion of a state forest that is a nature preserve.
- (2) A reservoir property administered by the division of state parks and reservoirs.
- (3) A wildlife area administered by the division of fish and wildlife, including a portion of a wildlife area that is a nature preserve.
- (4) A nature preserve not otherwise approved for hunting under this subsection if approved in a written authorization by the director of the division of nature preserves.

(e) A person hunting on any of the areas described in subsection (d) must do the following:

- (1) Comply with all federal and state:
  - (A) hunting;
  - (B) trapping; and
  - (C) firearms;

laws.

(2) On a fish and wildlife area and a reservoir property, obtain a one (1) day hunting permit and record from a checking station. The person must:

- (A) retain the permit and record card while in the field for the authorized date; and
- (B) as directed, return them to the department.

(3) Refrain from hunting on a nature preserve if prohibited by signage posted at the site.

(f) Unless otherwise posted or designated on a property map, a person must not place a trap except as authorized by a license issued for a property by an authorized representative. This license is in addition to the licensing requirement for traps set forth in IC 14-22-11-1.

(g) A person must not run dogs, except:

- (1) during the lawful pursuit of wild animals; or
- (2) as authorized by a license for field trials or in a designated training area.

A property administered by the division of fish and wildlife may be designated for training purposes without requiring a field trial permit. Only dogs may be used during field trials on a DNR property, except where authorized by a license on a fish and wildlife property.

(h) A person must not ~~leave~~ **construct or place** a ~~portable~~ tree blind or ~~use~~ **other hunting** blind ~~unattended except for the period authorized by 312 IAC 9-3-2(1) under 312 IAC 9-3-3 and 312 IAC 9-4-2.~~

- (i) The following terms apply to the use of shooting ranges:
  - (1) A person must not use a shooting range unless the person is:
    - (A) at least eighteen (18) years of age; or
    - (B) accompanied by a person who is at least eighteen (18) years of age.
  - (2) A person must:
    - (A) register with the department; and
    - (B) pay any applicable fees;
 before using a shooting range.
  - (3) Except as otherwise provided in this subdivision, a person must shoot only at paper targets placed on target holders provided by the department. An authorized representative may approve the use of alternative targets on a supervised shooting range if the department determines a hazard to public safety would not result.
  - (4) A person must fire downrange and take reasonable care to assure any projectile is stopped by the range backstop.
  - (5) Shot not larger than size 6 must be used on a shotgun range.
  - (6) A person must not:
    - (A) discharge a firearm using automatic fire;
    - (B) use tracer, armor-piercing, or incendiary rounds;
    - (C) play on, climb on, walk on, or shoot into or from the side berms; or
    - (D) shoot at clay pigeons, except on a site designated for shooting clay pigeons.
 Glass and other forms of breakable targets must not be used on a shooting range.
  - (7) A person must dispose of the targets used by the person under section 2(a) of this rule.
  - (8) Permission must be obtained from the department in advance for a shooting event that involves any of the following:
    - (A) An entry fee.
    - (B) Competition for any of the following:
      - (i) Cash.
      - (ii) Awards.
      - (iii) Trophies.
      - (iv) Citations.
      - (v) Prizes.
    - (C) The exclusive use of the range or facilities.
    - (D) A portion of the event occurring between sunset and sunrise.
  - (9) On a field course, signs and markers must be staked. Trees must not be marked or damaged.

(j) A person must not take a reptile or amphibian unless the person is issued a scientific collector purposes license under 312 IAC 9-10-6. Exempted from this subsection are:

- (1) eastern snapping turtles taken under 312 IAC 9-5-2; and
- (2) frogs smooth softshell turtles;
- (3) spiny softshell turtles;
- (4) bullfrogs; and
- (5) green frogs;

taken under 312 IAC 9-5-3; 312 IAC 9-5-6 from a DNR property where hunting or fishing is authorized.

**(k) A person must not possess lead shot while hunting mourning doves on a DNR property.**  
*(Natural Resources Commission; 312 IAC 8-2-3; filed Oct 28, 1998, 3:32 p.m.: 22 IR 739, eff Jan 1, 1999; filed Nov 5, 1999, 10:14 a.m.: 23 IR 553, eff Jan 1, 2000; filed Jun 17, 2002, 4:13 p.m.: 25 IR 3714; filed Sep 19, 2003, 8:14 a.m.: 27 IR 456; readopted filed Nov 17, 2004, 11:00 a.m.: 28 IR 1315; filed Sep 14, 2005, 2:45 p.m.: 29 IR 461, eff Jan 1, 2006; filed Jul 11, 2006, 9:04 a.m.: 20060802-IR-312060009FRA; filed Sep 6, 2007, 12:20 p.m.: 20071003-IR-312070023FRA; filed Mar 11, 2008, 9:34 a.m.: 20080409-IR-*

*312070449FRA; filed Mar 12, 2010, 1:25 p.m.: 20100407-IR-312090470FRA, eff Jan 1, 2011; readopted filed Mar 25, 2010, 2:58 p.m.: 20100421-IR-312100037RFA)*

SECTION 3. 312 IAC 8-2-8 IS AMENDED TO READ AS FOLLOWS:

**312 IAC 8-2-8 Vehicles, trails, boats, and aircraft**

**Authority:** IC 14-10-2-1; IC 14-10-2-4; IC 14-11-2-1; IC 14-19-1-1

**Affected:** IC 14-19-1-0.5; IC 14-22-11-1

Sec. 8. (a) A person must not operate a vehicle:

(1) at a speed greater than:

(A) thirty (30) miles per hour on straight, open stretches of road; or

(B) fifteen (15) miles per hour on steep grades or curves or where posted; or

(2) except as provided in section 17 of this rule, other than on a public road.

(b) A person must not park:

(1) a vehicle;

(2) a boat; or

(3) associated equipment;

except at a site designated by the department.

(c) A person must not operate a motorized cart on a DNR property except as follows:

(1) The person must demonstrate both of the following:

(A) The person holds a valid driver's license.

(B) The person:

(i) is at least sixty-five (65) years of age that is evidenced by the valid driver's license; or

(ii) has a disability, as defined by the federal Social Security Administration guidelines (42 U.S.C. 416), that is evidenced by documentation from the Social Security Administration.

(2) A person must not operate a motorized cart other than within a campground.

(3) A motorized cart must, if operated between the hours of sunset and sunrise, have a lamp on the:

(A) front exhibiting a white light visible at least five hundred (500) feet ahead of the motorized cart; and

(B) rear exhibiting a red light visible at least five hundred (500) feet behind the motorized cart.

(4) A restriction applicable to the operation, parking, or other use of a vehicle under this section also applies to a motorized cart.

(5) As used in this subsection, "motorized cart" has the meaning set forth in IC 14-19-1-0.5.

(d) A person moving cross-country on a trail must remain on the designated pathway for the trail.

A person must not:

(1) hike;

(2) bike;

(3) ski;

(4) horseback ride; or

(5) operate an off-road vehicle or snowmobile;

except on a trail designated for the purpose. A person must not ride, lead, drive, or hitch an animal, except where designated by the department.

(e) A person must not launch, dock, or moor a boat, except:

- (1) for approved periods; and
- (2) at sites designated by the department for those purposes.

(f) A person must not:

- (1) leave a boat unattended in a courtesy dock provided by the department; or
- (2) moor a boat at a designated group dock or mooring post unless the boat exhibits a valid mooring permit.

(g) A person must not operate or maintain a boat on a lake unless the person does each of the following:

(1) Operates the boat according to any horsepower or speed restrictions applicable to the lake.

(2) Except as provided in subdivisions (3) and (6), obtains and displays a valid annual boat lake permit as follows:

(A) Purchase from the department a boat lake permit under a fee schedule approved by the commission.

(B) Affix the permit in a visible location on the forward half of the boat.

(3) Except as provided in subdivision (6), for a motorboat, obtains and displays a valid annual motorboat lake permit as follows:

(A) Purchase from the department a motorboat lake permit under a fee scheduled approved by the commission.

(B) Affix the permit in a visible location on the port (left) side immediately following the excise tax decal or registration number.

(4) For a lake containing fewer than three hundred (300) acres, operates a motorboat only if the motorboat is either of the following:

(A) Powered by an electric trolling motor with not more than:

(i) two (2) 12-volt batteries; or

(ii) one (1) 24-volt battery.

(B) Operated on Loon Lake, Otter Lake, or Blue Grass Pit in the Blue Grass Fish and Wildlife Area at not greater than idle speed.

(5) Removes a boat from the lake before the expiration of fourteen (14) consecutive days, unless the boat is moored in an area where the department has approved mooring for a longer duration.

(6) A lake located on a DNR property administered by the division of fish and wildlife is exempted from subdivisions (2) and (3).

(h) A person must not leave a vehicle, boat, or associated equipment at a DNR property unless the person is actively engaged in the use of:

(1) a DNR property; or

(2) an adjacent:

(A) public freshwater lake; or

(B) navigable waterway.

(i) A person must not land, taxi, take-off, park, or moor:

(1) an ~~aircraft~~ **airborne human transportation device**; or

(2) a ~~hang glider~~ **motor-driven airborne device**;

(3) an ultralite;

(4) a ~~powered model aircraft~~; or

(5) a hot air balloon;

except at a site designated for that purpose or pursuant to a license. (*Natural Resources Commission; 312 IAC 8-2-8; filed Oct 28, 1998, 3:32 p.m.; 22 IR 741, eff Jan 1, 1999; filed Nov 5, 1999, 10:14 a.m.; 23 IR*



*555, eff Jan 1, 2000; filed Jun 17, 2002, 4:13 p.m.: 25 IR 3715; readopted filed Nov 17, 2004, 11:00 a.m.: 28 IR 1315; filed Sep 14, 2005, 2:45 p.m.: 29 IR 463, eff Jan 1, 2006; filed Jun 9, 2006, 3:40 p.m.: 20060705-IR-312050344FRA; filed Jun 29, 2007, 2:32 p.m.: 20070725-IR-312060333FRA; readopted filed Mar 25, 2010, 2:58 p.m.: 20100421-IR-312100037RFA; filed Aug 18, 2011, 11:38 a.m.: 20110914-IR-312100668FRA)*

SECTION 4. 312 IAC 8-2-9 IS AMENDED TO READ AS FOLLOWS:

**312 IAC 8-2-9 Swimming, snorkeling, scuba diving, and tow kite flying**

**Authority: IC 14-10-2-4; IC 14-11-2-1**

**Affected: IC 14**

Sec. 9. (a) A person must not swim, or allow a child or other person in the person's care to swim, other than at the following locations:

- (1) At a designated swimming beach or pool during designated hours.
- (2) From a boat between sunrise and sunset in an embayment on a reservoir property established under 312 IAC 5-10 as an idle speed zone, but not:
  - (A) in a causeway; or
  - (B) within one hundred (100) feet of a designated launching ramp or other public use facility.

(b) A person must not snorkel, except from a boat on a reservoir property and within an embayment designated as an idle speed zone.

(c) A person must not scuba dive unless in compliance with each of the following:

- (1) A license is issued by the department.
- (2) Between the hours of sunrise and sunset.
- (3) A diving flag is displayed to designate the area in use.

~~(d) A person must not engage in tow kite flying, except during the following periods:~~

- ~~(1) On weekdays from sunrise to sunset.~~
- ~~(2) Except as provided in subdivision (3), on Saturdays, Sundays, or holidays, from sunrise until 11 a.m. and from 5 p.m. until sunset.~~
- ~~(3) On:~~
  - ~~(A) Memorial Day weekend;~~
  - ~~(B) the Fourth of July and a Saturday or Sunday that immediately precedes or follows the Fourth of July; and~~
  - ~~(C) Labor Day weekend;~~

~~from sunrise until 11 a.m.~~

*(Natural Resources Commission; 312 IAC 8-2-9; filed Oct 28, 1998, 3:32 p.m.: 22 IR 741, eff Jan 1, 1999; filed Sep 19, 2003, 8:14 a.m.: 27 IR 458; readopted filed Nov 17, 2004, 11:00 a.m.: 28 IR 1315; filed Jul 11, 2006, 9:04 a.m.: 20060802-IR-312060009FRA; errata filed Jun 2, 2009, 10:29 a.m.: 20090624-IR-312090386ACA; readopted filed Mar 25, 2010, 2:58 p.m.: 20100421-IR-312100037RFA)*



## EFFECTS OF LEAD SHOT INGESTION ON CAPTIVE MOURNING DOVE SURVIVABILITY AND REPRODUCTION

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**Abstract:** The effects of lead (Pb) shot ingestion on survivability and reproduction of captive mourning doves (*Zenaidura macroura*) were investigated during 1982-83. Survivability was studied in January and February 1983. Doves were randomly assigned treatments (25/treatment) and force fed 0, 1, 2, or 4 No. 8 Pb shot. Mortality among controls and those receiving 1, 2, or 4 pellets was 0, 24, 60, and 52%, respectively. Kidney and liver Pb concentrations in birds that died (TD) were higher ( $P < 0.05$ ) at all dosages than in control (CS) or treatment (TS) doves that survived (all dosages). Bone Pb concentrations for TS and TD doves dosed with 1 Pb shot were not different ( $P > 0.05$ ) from CS birds. TS and TD doves dosed with 2 or 4 pellets had higher ( $P < 0.05$ ) bone Pb concentrations than CS doves, but there were no differences ( $P > 0.05$ ) among any of the treatments in the TS and TD groups. Another sample of 50 captive doves was tested for effects on reproduction. In January 1982, 25 treatment females were force fed 1 No. 8 Pb shot; another 25 females were untreated. Paired doves were allowed to conduct reproductive activities through September. There were no differences ( $P > 0.05$ ) in egg measurements (length, width, and weight), productivity, fertility, or squab weight; but a difference ( $P < 0.05$ ) in hatchability did occur between treatments.

J. WILDL. MANAGE. 50(1):1-8

Poisoning from the ingestion of spent Pb shotgun pellets has long been considered a mortality factor in waterfowl populations (Bellrose 1959). In contrast, relatively little is known about the effects or incidence of Pb poisoning in upland game birds. Pb shot ingestion has been reported in a northern bobwhite (*Colinus virginianus*) (Westemeier 1966), a scaled quail (*Callipepla squamata*) (Campbell 1950), a ring-necked pheasant (*Phasianus colchicus*) (Hunter and Rosen 1965), a wild turkey (*Meleagris gallopavo*) (Stone and Butkas 1978), and in mourning doves (Locke and Bagley 1967, Lewis and Legler 1968, Kendall and Scanlon 1979, Buerger et al. 1983).

Pb shot should be more accessible to mourning doves than other upland game birds because they are hunted over fields in which they feed. Large quantities of Pb shot ( $\leq 108,900$  shot/ha) have been found on recently hunted dove fields (Lewis and Legler 1968), and the incidence of lead shot in the gizzards of wild mourning doves has ranged from 1 to 6.5% (Locke and Bagley 1967, Lewis and Legler 1968, Kendall and Scanlon 1979, Buerger et al. 1983).

Although there have been reports of mourning doves being exposed to Pb shot, little Pb-related research has been conducted on this species. Dose-response mortality studies have demonstrated that mourning doves are susceptible to Pb shot poisoning, but experimental designs rendered the results inconclusive (McConnell 1968).

Other studies with mourning doves (Kendall et al. 1983) and ringed turtle-doves (*Streptopelia risoria*) (Kendall et al. 1981, 1982) considered sublethal effects of Pb shot ingestion. Ringed turtle-doves did suffer high (5 out of 7) mortality when treated with Pb shot and exposure to cold temperatures (Kendall et al. 1981). Environmental conditions may be especially important when considering Pb shot contamination in mourning doves because Pb shot ingestion is most probable during or after hunting seasons, which often occur during periods of environmental stress.

The effect of Pb shot ingestion on the reproductive success of columbids has received less attention. No literature is available concerning these effects in mourning doves. Short-term Pb acetate treatment had no adverse effects on productivity or fertility in ringed turtle-doves (Kendall 1980, Kendall and Scanlon 1981).

The objectives of this study were to investi-

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gate the effects of Pb shot ingestion on the survivability of captive mourning doves held in outdoor facilities and to determine the effects of Pb shot ingestion on the reproductive success of doves maintained under controlled conditions.

We acknowledge the graduate students who assisted in this project, particularly L. I. Muller for help with data collection. W. M. Buerger aided in all phases of this research. We thank G. A. Baldassarre, M. K. Causey, G. H. D'Andrea, C. A. Sundermann, and L. C. Wit for reviewing various versions of this manuscript and providing editorial assistance. Tissue Pb determinations and necropsies were performed at the C. S. Roberts Vet. Diagn. Lab. This study was supported by an Ala. Acad. Sci. Student Res. Grant and by Ala. Agric. Exp. Stn. Proj. 13-0048. This is contribution J. Ser. 16-85152, Ala. Agric. Exp. Stn., Auburn. Please address reprint requests to R. E. Mirarchi.

## MATERIALS AND METHODS

### Trapping and Acclimatization Procedures

Wild mourning doves were trapped on and around the Auburn University campus, Auburn, Alabama, using modified Kniffin funnel traps baited with cracked corn. Trapped birds having lesions suggestive of avian pox (*Poxvirus avium*) or trichomoniasis (*Trichomonas gallinae*) were released. Newly captured doves were placed in quarantine for  $\geq 4$  weeks prior to introduction into the captive colony and an additional 2 months were allotted for acclimatization before any bird was subjected to experimentation.

### Survivability Study

**Housing.**—Doves were housed in 20 outdoor cages to simulate naturally prevailing weather conditions. Each cage measured approximately  $1.2 \times 1.8 \times 1.8$  m and contained 2 horizontal perches 1.5 m from the cage bottom. A portion of the upper rear of each cage was shielded on the top and 3 sides and contained 2 resting platforms. Loblolly pine (*Pinus taeda*) straw was placed on the bottom of the cage.

Food and distilled water were provided ad libitum. Doves were introduced to a diet of approximately 95% cracked corn, 5% Purina Pigeon Chow Checkers®, and <1% oystershell grit 3 weeks prior to experimentation. The distilled water contained 0.001  $\mu\text{g/g}$  of Pb.

**Dosing.**—Treatments were assigned randomly regardless of sex. Seventy-five doves (25 birds/treatment) were dosed with either 1, 2, or 4 No. 8 Pb shot ( $\bar{x}$  of shot = 72.0 mg). No. 8 Pb shot was selected because it is commonly used by dove hunters. Dosage rates closely paralleled the numbers of Pb shot previously reported in the gizzards of wild doves (Locke and Bagley 1967, Lewis and Legler 1968, Kendall and Scanlon 1979, Buerger et al. 1983). Dosing was accomplished by gently opening the bill, extending the neck, dropping the prescribed number of pellets into the back of the mouth, and massaging the throat until the pellets had been swallowed. An additional 25 control birds received a browntop millet (*Panicum fasciculatum*) seed.

All doves were dosed and randomly placed in the cages (5/cage) on 9 January 1983, near the end of hunting season; the experiment was terminated on 12 February 1983, before the breeding season.

**Data Collection and Tissue Analysis.**—Doves were checked daily between 1300 and 1400 hours. Dead birds were necropsied, but if immediate examination was impossible, specimens were refrigerated for 1–2 days. Samples of kidney, liver, and radius and ulnar bones were analyzed for Pb. Analysis was performed with a Perkin-Elmer atomic absorption spectrophotometer using a graphite furnace (Stahr 1977) and the manufacturer's recommended dry-ashing procedure (Perkin-Elmer Corp. 1980). At the end of the experiment 40 surviving birds (10/treatment) were sacrificed for comparison. Contents of all digestive tracts were examined at necropsy for Pb pellets, but no attempt was made to account for pellets excreted prior to necropsy.

Weather data were obtained from the Southeast Agricultural Weather Service Center at Auburn University located approximately 300 m from the aviary facility. Weather conditions considered were maximum, minimum, and mean temperature; relative humidity; vegetative wetting; and wind direction and speed.

### Reproductive Study

**Housing.**—Doves were housed indoors in  $50 \times 48 \times 33 \times 23$ -cm cages. Food was provided ad libitum and consisted of approximately 60% Purina Pigeon Chow Checkers®, 20% cracked corn, 20% browntop millet, and <1% oystershell grit. This ration was introduced almost 6 months prior to experimentation and had a

mean Pb concentration of 0.22 µg/g wet weight. Distilled water also was provided ad libitum.

Doves were maintained under thermostatically controlled temperature conditions ( $22 \pm 3$  C) and under a lighting regime that approximated the natural photoperiod.

**Pairing and Dosing.**—Male-female pairs were formed and observed for 2 weeks to determine if males and females were compatible. If not, new pairings were made until suitable mates were found.

Treatments were randomly assigned, and the females of each pair were treated. The treated birds ( $N = 25$ ) each received 1 No. 8 Pb shot while the control birds ( $N = 25$ ) each received 1 browntop millet seed. Only 1 shot was used so the effects of a baseline dosage level could be determined. Dosing was performed as in the previous experiment and occurred on 31 January 1982. The experiment was terminated on 26 September 1982.

**Data Collection.**—Birds were checked daily between 1700 and 1800 hours for egg production. Eggs were collected and length, width, and weight measurements taken. Eggs then were incubated at an average temperature of  $37.5 \pm 0.3$  C, a hygrometer reading of 29.4 C (approximately 55.5% relative humidity), and an ambient room temperature of 21.1–23.9 C. Candling was done to determine fertility after 7 days incubation. Fertile eggs were returned to the incubator while nonfertile eggs were discarded. If an egg was fertile, but development was obviously retarded, the egg was opened and the embryo was removed for age determination (Muller et al. 1984).

After 14 days incubation eggs were placed in a hatcher with an average temperature of  $37.5 \pm 0.3$  C, a hygrometer reading of 31.7 C (approximately 65.5% relative humidity), and the same room temperature as previously described. The hatcher was checked daily and newly hatched squabs were asphyxiated with chloroform and weighed. After 3 days in the hatcher unhatched eggs were removed and opened to determine embryo age.

### Statistical Analyses

Differences in mortality among treatments and between sexes within treatments were determined using Chi-square analysis. Student's *t*-test was used to detect differences in tissue Pb residue means between sexes within a treatment. Comparison of tissue Pb residue means among treatments was performed using analy-

Table 1. Mortality of mourning doves (25/group) treated by force feeding No. 8 lead shot in Alabama, 9 January–12 February 1983.

N pellets fed	Doves dying	
	N	%
0	0 A <sup>a</sup>	0
1	6 B	24
2	15 C	60
4	13 C	52

<sup>a</sup> Values with different capital letters in the same column are significantly different ( $P < 0.05$ ).

sis of variance, and Duncan's multiple range test was used as a means separation technique. Simple correlation was used to determine if relationships existed between incidence of death and weather variables.

Differences between treatments in productivity (number of eggs laid), fertility [(number of fertile eggs/number of eggs laid)  $\times 100$ ], hatchability [(number of eggs hatched/number of fertile eggs)  $\times 100$ ], and egg measurements were determined using Student's *t*-test. Trends in embryonic mortality were examined with simple linear regression. All analyses, except Chi-square tests, were performed using the Statistical Analysis System (SAS Institute Inc. 1982a,b).

## RESULTS AND DISCUSSION

### Survivability Study

**Mortality.**—Mourning doves dosed with Pb shot had greater mortality ( $P < 0.05$ ) than control birds, and those that received 2 or 4 pellets had greater mortality ( $P < 0.05$ ) than those dosed with 1 pellet (Table 1). Mortality began 2 days postdosing, and 97% of the doves that died did so in  $\leq 11$  days. There were no differences ( $P > 0.05$ ) in mortality between sexes within a treatment. Other studies with small sample sizes of mourning doves (McConnell 1968, Kendall et al. 1983) and ringed turtle-doves (Kendall et al. 1982) had lower mortality after Pb shot dosing. The discrepancies between those reports and the present study may reflect differences in diet or in experimental procedures. The studies cited above did not subject experimental birds to stressful environmental conditions.

**Tissue Pb Concentrations.**—Subsequent to ingestion of Pb shot, TD doves had higher ( $P < 0.05$ ) kidney and liver Pb concentrations than CS or TS doves, but there were no differences

Table 2. Lead concentration ( $\mu\text{g/g}$  dry wt) in selected tissues of mourning doves treated by force feeding No. 8 lead shot in Alabama, 9 January–12 February 1983.

N pellets fed	Group <sup>a</sup>	N	Pb concentration: $\mu\text{g/g}$ (range)		
			Kidney	Liver	Bone
0	CS	10	9.5 A <sup>b</sup> 3.6 (0.0–29.3)	1.4 A 0.3 (0.3–2.8)	37.5 A 20.7 (4.7–219.5)
1	TS	10	20.4 A 4.9 (5.6–57.6)	2.9 A 0.5 (0.5–5.5)	113.9 AB 13.0 (47.4–182.5)
2	TS	10	80.5 A 39.0 (3.4–363.0)	20.5 A 9.6 (0.6–80.0)	169.2 B 33.9 (58.1–356.4)
4	TS	10 <sup>c</sup>	46.4 A 17.2 (6.1–167.1)	4.5 A 1.0 (1.1–9.0)	198.2 B 39.9 (46.7–435.0)
1	TD	6	230.3 B 54.5 (71.0–414.0)	80.5 B 33.0 (23.0–238.0)	116.2 AB 27.6 (56.0–234.0)
2	TD	15	299.2 B 63.4 (103.0–919.0)	89.3 B 20.1 (16.0–340.0)	173.0 B 31.6 (25.0–550.0)
4	TD	13	257.2 B 33.5 (110.0–587.0)	93.3 B 12.2 (37.0–208.0)	192.7 B 34.7 (88.0–563.0)

<sup>a</sup> CS = control birds that were sacrificed, TS = treatment birds that were sacrificed, TD = treatment birds that died postdosing.

<sup>b</sup> Means with different capital letters in the same column are significantly different ( $P < 0.05$ ).

<sup>c</sup> N = 9 for liver.

( $P > 0.05$ ) between CS or TS birds (Table 2). There also were no differences ( $P > 0.05$ ) in tissue residues between sexes.

Kidney and liver Pb concentrations for CS doves compare favorably with other studies on wild (Kendall and Scanlon 1982a) and captive (Kendall et al. 1983) mourning doves and rock doves (*Columba livia*) from rural (Johnson et al. 1982) and urban areas (Kendall and Scanlon 1982b). Tissue concentrations reported here were higher than those observed in other studies with mourning doves (Bagley and Locke 1967), ringed turtle-doves (Kendall et al. 1981, 1982), and rock doves (Johnson et al. 1982).

Pb concentrations in kidneys of TS birds (Table 2) were lower than those already reported for doves receiving Pb shot (Kendall et al. 1981, 1982, 1983). Liver Pb concentrations in TS birds (Table 2) were comparable to those of ringed turtle-doves that survived Pb dosing studies (Kendall et al. 1982), but these values were lower than those previously reported for captive mourning doves (Kendall et al. 1983) and cold-stressed ringed turtle-doves (Kendall et al. 1981) dosed with Pb pellets. In those experiments sacrifice occurred at, or prior to, 14 days postdosing. In our experiment, sacrifice occurred 35

days after dosing, possibly permitting decreases in both kidney and liver Pb concentrations. Additionally, in our study, Pb pellets excreted postdosing may have influenced tissue Pb accumulations.

TD doves had kidney and liver Pb concentrations lower than those reported for ringed turtle-doves that died after being dosed with 4 No. 6 Pb shot and then being exposed to cold temperatures (Kendall et al. 1981), but the higher quantity of Pb given the turtle-doves and the reintroduction of voided pellets were confounding factors. Work with mallards (*Anas platyrhynchos*) suggests that liver Pb levels of 6–20  $\mu\text{g/g}$  wet weight (approx 18–61  $\mu\text{g/g}$  dry wt, Scanlon 1982) and kidney Pb > 20  $\mu\text{g/g}$  wet weight should be considered indicative of acute Pb exposure (Longcore et al. 1974b). This study supports those data and the suggestion that both liver and kidney Pb concentrations are important in the determination of Pb toxicosis (Longcore et al. 1974b).

Trends in bone Pb residues were not as well defined as those in kidney and liver. There were no differences ( $P > 0.05$ ) in bone Pb concentrations among CS, TS, and TD doves dosed with 1 Pb shot (Table 2). The concentrations

for CS doves were similar to those found in wild mourning doves in Virginia (Kendall and Scanlon 1982a) and suburban rock doves in England (Johnson et al. 1982). The concentrations for TS and TD individuals approached those of captive female mallards dosed with 1 No. 8 Pb shot (Finley et al. 1976). The TS and TD doves that received 2 and 4 pellets had higher ( $P < 0.05$ ) bone Pb concentrations than the CS doves, but there were no differences ( $P > 0.05$ ) among any of the treatments in the TS and TD groups (Table 2). Values of bone Pb for doves dosed with 4 Pb shot were lower than previously reported for similarly dosed captive mourning doves (Kendall et al. 1983). All of these data support the contention that elevated Pb concentrations in bone may result from acute high-level exposure (e.g., TS and TD doves) or chronic low-level exposure (e.g., CS doves exposed to Pb prior to capture) (Longcore et al. 1974b). High bone Pb may not be an important indicator of toxicity in mourning doves compared to elevated kidney and liver Pb.

Examination of digestive tracts at necropsy indicated that some of the Pb shot given mourning doves may have been excreted; e.g.,  $\bar{x} = 2.3$  pellets recovered for TD doves given 4 Pb shot. Voided pellets were not reintroduced, and because of the uncertainty of the exact amount of Pb each bird received, it may be more accurate to report tissue Pb levels for all 3 treatments combined (1, 2, and 4 pellets) in the TS and TD groups. Analysis of these data emphasize the trends discussed previously for kidney and liver concentrations. Mean bone Pb concentrations for TS (160.4  $\mu\text{g/g}$ ,  $N = 30$ ) and TD (170.5  $\mu\text{g/g}$ ,  $N = 34$ ) doves were higher ( $P < 0.05$ ) than for CS birds (37.5  $\mu\text{g/g}$ ,  $N = 10$ ).

**Factors Influencing Mortality and Pb Concentrations.**—Although it appears that the increased mortality and high Pb concentrations observed in the present study resulted from Pb poisoning, other factors may have influenced the results. Both Pb-treated ringed turtle-doves (Kendall et al. 1981) and mallards (J. D. Sullivan, unpubl. rep., Arkansas Game and Fish Comm., 1980) were adversely affected by exposure to cold. Cold temperatures during our study may have acted in concert with other variables to create a stressful situation that increased the susceptibility of mourning doves to Pb toxicosis. Although there was no direct statistical correlation ( $P > 0.05$ ) between weather

Table 3. Relation of No. 8 lead shot ingestion to indices of reproductive success for captive female mourning doves in Alabama, spring and summer 1982.

N pellets fed		Reproductive success		
		Productivity (eggs/female)	Fertility (%)	Hatchability (%)
0	$\bar{x}$	27.9 A <sup>a</sup>	84.5 A	78.5 A
	SE	3.3	4.8	3.0
	N <sup>b</sup>	25	23	23
1	$\bar{x}$	23.4 A	81.5 A	62.3 B
	SE	3.5	5.4	5.8
	N	25	19	18

<sup>a</sup> Means with different capital letters in the same column are significantly different ( $P < 0.05$ ).

<sup>b</sup> N females on which mean is based.

variables and incidence of death, 91% of the doves died on days when the minimum temperature was  $\leq 0^\circ\text{C}$ . All doves given 1 Pb shot and maintained indoors under controlled temperature conditions survived the companion 8-month reproductive study.

Diet also may have influenced the results. Corn diets in Pb-dosing studies increased mortality (Jordan and Bellrose 1950; Elder 1954; Finley and Dieter 1978b; Sullivan, unpubl. rep.). The increased gizzard activity associated with corn diets may cause more Pb pellet erosion. Oystershell grit appears to mollify the effects of Pb poisoning (Godin 1967; Longcore et al. 1974a). Because we observed wild mourning doves ingesting more quartz-like grit particles, those that pick up Pb shot may actually suffer higher mortality than the doves reported here.

### Reproductive Study

**Mortality.**—There was no mortality associated with Pb dosing (1 No. 8 Pb shot) in this experiment, in contrast to the increased mortality observed in the previous experiment. This may have been due to the moderate temperatures during the reproductive study and the use of a diet necessitating less gizzard activity (high amount of pelleted ration).

**Egg and Squab Measurements.**—There were no differences ( $P > 0.05$ ) between CS and TS doves in mean egg length (CS = 28.1 mm and TS = 28.5 mm), width (CS = 21.3 mm and TS = 21.5 mm), weight (CS = 7.0 g and TS = 7.2 g), or squab weight (CS = 4.9 g and TS = 5.0 g). The values obtained were in general agreement with egg measurements reported for captive (Mirarchi 1978) and wild mourning doves (Holcomb and Jaeger 1978). Squab weights also were similar to those previously reported (Wetherbee

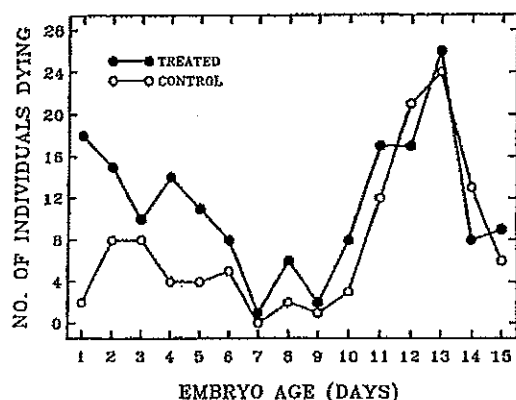


Fig. 1. Mortality of embryos from control and treated (force fed 1 No. 8 lead shot) captive female mourning doves in Alabama, spring and summer 1982.

and Wetherbee 1961, Holcomb and Jaeger 1978). Stowe et al. (1972) found that eggs laid by Pb-dosed domestic chickens were the same size as those produced by controls, but no literature is available as to the effects of Pb on mourning dove egg size and weight or squab weight.

**Reproductive Success Indices.**—Pb dosing of female mourning doves had no effect ( $P > 0.05$ ) on productivity or fertility (Table 3). Eggs produced by treated doves had lower ( $P < 0.05$ ) hatchability than those from controls (Table 3). Female ringed turtle-doves that received Pb acetate also did not suffer a decrease in productivity or fertility (Kendall 1980, Kendall and Scanlon 1981). The productivity of northern bobwhites dosed with Pb shot was not influenced, but eggs of Pb-treated northern bobwhites had reduced fertility and hatchability (McConnell 1968). Those data were not subjected to statistical analysis. Japanese quail (*Coturnix coturnix japonica*) had reduced productivity when both high (Stone and Soares 1976) and low levels (Edens et al. 1976) of Pb were added to their diets. In studies with Pb-dosed mallards Elder (1954) noted reduced fecundity but no influence on fertility or hatchability. Further investigations with mallards reported no differences in productivity between control and treated females (Finley and Dieter 1978a). Differences between our study and previous studies may be due to species variability and/or the method and amount of Pb dosing, but this needs further investigation.

A difference in hatchability ( $P < 0.05$ ) with no difference in fertility ( $P > 0.05$ ) suggested that the survival of progeny from Pb-treated

adults was influenced. Mortality of control and treatment embryos was bimodal (Fig. 1), with peaks of mortality early and late in incubation. Riddle (1930) found comparable mortality distributions for mourning doves, ringed turtle-doves, and rock doves, but the incubation method was not specified.

Because the curves (Fig. 1) were bimodal it was necessary to divide the plot into 2 periods of incubation (1–9 and 10–15 days postlaying) for the most reliable comparisons between treatments. A higher incidence ( $P < 0.05$ ) of embryonic mortality occurred among the embryos of treated doves from 1 to 9 days postlaying. However, there were no differences ( $P > 0.05$ ) in embryonic mortality between treatments from 10 to 15 days postlaying. The increase in early embryonic mortality in treated doves may have resulted from the transfer of Pb from the adult female to the egg. Transfer of Pb from female parents to eggs and young has been reported in ringed turtle-doves (Kendall and Scanlon 1981). Injection of Pb into eggs containing embryos has resulted in central nervous system injury (McLaughlin et al. 1963), misplacement of organs (Franke et al. 1936), and other malformations (King and Liu 1974). The major cause of the early mortality of avian embryos during incubation is slow-developing blastoderms (Romanoff 1972:19). Pb injected into fertile eggs causes retardation of growth (Hammett and Wallace 1928, de Franciscis and Bocalatte 1962). In the present study Pb may have accumulated in the developing embryos of treated mourning doves and increased embryonic mortality through impairment of early development.

## CONCLUSIONS AND RECOMMENDATIONS

Mourning doves dosed with 1, 2, or 4 No. 8 Pb shot exhibited higher mortality than control birds. The increased mortality was reflected in higher tissue Pb concentrations, especially kidney and liver. Adverse environmental conditions and diet may have influenced mortality and tissue accumulations of Pb.

Ingestion of 1 No. 8 Pb shot by female doves caused a reduction in hatchability of their eggs but did not influence productivity or fertility. Decreased hatchability resulted from higher early embryonic mortality, possibly due to the transfer of Pb from the adult to the embryo via the egg.



The combined results of these 2 studies suggest that if female mourning doves ingest Pb shot they may suffer increased mortality, but if they survive and breed they may experience a decrease in reproductive potential.

Additional studies are needed to investigate the relationships among mortality, dosage level, diet, and environmental conditions. Dosing and radiotracking wild doves might provide valuable information on the influence of Pb shot ingestion on survivability under natural conditions. More research also must be conducted to determine what effects various dosages of Pb shot given to males, females, and both sexes combined will have on reproductive success. Future work should consider the specific mechanisms by which Pb may alter mourning dove reproductive capabilities. Finally, to assess the importance of Pb poisoning in mourning dove populations, more information is needed on Pb shot availability, ingestion rates, and the influence of various agricultural practices on continued availability of Pb shot in the environment.

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Received 13 March 1985.

Accepted 10 June 1985.